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Publication date:
2011

Document Version
Early version, also known as pre-print

Discussion paper

BANK RISK-TAKING ABROAD: DOES HOME-COUNTRY REGULATION AND SUPERVISION MATTER?

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February 2011

European Banking Center Discussion Paper
No. 2011-007

This is also a CentER Discussion Paper
No. 2011-032

ISSN 0924-7815

Bank Risk-Taking Abroad: Does Home-Country Regulation and Supervision Matter?*

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February 2011

Abstract

This paper provides the first empirical evidence on how home-country regulation and supervision affects bank risk-taking in host-country markets. We analyze lending by 136 banks to 8,253 firms in 1,513 different localities across 13 countries. We find strong evidence that laxer regulatory restrictions in the home country are associated with higher loan rejection rates by banks in host-country markets, but that the resulting loans are mostly to small, unaudited, nonexporting, and innovative firms. The results are stronger when banks are less efficiently supervised at home, and they are observed independently from the effect that bank balance sheets have on lending. These findings imply that loose home-country regulation and supervision are associated with important negative externalities for the host-country in terms of more risk-taking by cross-border banks.

JEL classification: G21, G28, G32.

Keywords: bank regulation, cross-border financial institutions, financial risk.

*We thank Dana Schaffer and Francesca Fabbri for outstanding research assistance, and seminar participants at De Nederlandsche Bank for useful comments. The opinions expressed herein are those of the authors and do not necessarily reflect those of the ECB or the Eurosystem.

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1 Introduction

Does the strictness of home-country bank regulation and supervision affect bank risk-taking abroad? Although of crucial importance this question has never received an adequate treatment in the empirical banking literature. A priori, the answer to this question is unclear as well. Stricter home-country regulation may lead banks to act accordingly and conservatively abroad, for example, through explicit home-country rules or by inducing them to act "as if they are at home." This appears in general to be consistent with the empirical literature that has found that foreign-owned banks operating in emerging markets are more prudent than domestic banks (e.g., Crystal et al., 2002). Alternatively, multinational banks may embark on a deliberate strategy of risk-taking abroad to make up for the lack of risk-taking in their home-country market. For example, international banks may have an incentive to relegate to their foreign subsidiaries (i.e., the bank's "periphery") their riskier activities to which they limit their exposure (Powell and Majnoni, 2007). More generally, this could simply reflect a "search for yield" (Goldberg 2009). The goal of this paper is to provide the first empirical test of these competing hypotheses.

We analyze bank risk-taking abroad and how it relates to the degree of home-country regulation and supervision using an extensive firm-level dataset from emerging markets. We use data on SME financial and non-financial charateristics to derive local measures of bank-lending behavior and risk-taking. We ask two main questions regarding home-country "regulation" (i.e., the rules that constrain bank condition, behavior, and activities) and home-country "supervision" (i.e., regulator monitoring of bank condition, behavior, and activities). First, we investigate whether loan underwriting in local host-country markets is affected by how restrictive home-country regulation and how efficient home-country supervision is. We then study whether home-country regulation and supervision exhibits a differential effect on loan-granting depending on the firm risk involved. This combined strategy allows us to make inferences about the cross-border externalities associated with domestic regulation and supervision, as well as about the type of firms that may benefit from it.

Our key data come from the 2005 and 2008 waves of the World Bank-EBRD BEEPS survey of

SMEs in emerging Europe. These data allow us to directly observe firms whose loan application was turned down by a bank during the previous year. We combine these loan rejection rates with data on the stringency and efficiency of regulation and supervision in the home-country where the parent bank is located. Although we do not have a direct match between firms and banks, we can observe the precise locality in which each firm operates, as well as all banks that are present in this locality. We can therefore match firms and banks through this geographic proximity. We focus on host-country localities that are dominated by branches and subsidiaries of foreign banks. The final sample consist of $8,253$ firms in $1,513$ localities served by a total of 136 banks.

We face two main challenges in our analysis. First, the banks' entry decisions are not made randomly, i.e., banks tend to choose their foreign markets of operation; for example, South-Eastern Europe has a large presence of Greek banks, while the Baltic countries are dominated by Scandinavian banks. A cross-country study of lending behavior would then suffer from a standard omitted (macro) variables problem if banking markets only vary by (host) country. We circumvent this problem by employing a within-country cross-locality analysis. Essentially, we are comparing two localities within the same (host) country, one of which is served by international banks domiciled in tightly regulated (home) countries, and the other by international banks domiciled in (home) countries with lax regulation. This allows us to net out the effect of (host) country-level omitted variables with (host) country fixed effects. Second, using loan rejection rates to define risk-taking may be prone to a selection bias as applicant firms may be a systematically truncated sub-sample of all firms. For example, some firms do not apply because they do not need credit, while others do not apply because they are discouraged. If, for example, financially stronger firms account for a larger share of all firms in local markets dominated by banks from tightly regulated markets, we would overestimate the effect of home-country regulation on host-country risk-taking. By observing data on non-applicant firms we are able to address this question in a standard two-step selection framework (see Popov and Udell, 2010, and Ongena and Popov, 2011, for recent applications).

We provide the first empirical evidence that lax home-country regulation of cross-border banks is associated with negative externalities in host-countries through bank risk-taking. By "risk-taking" we mean lending to firms that are both more observably risky and/or more opaque (i.e., firms

whose risk is not easily observable). Our key findings are threefold. First, banks are less likely to grant loans in the host-country if home-country regulation is lax. Among the set of regulatory practices, state ownership of banks and restrictions on entry in banking markets are the most potent. Second, this lower likelihood of extending a loan is associated with the extension of loans primarily to riskier corporate clients, such as small, informationally opaque, and innovative firms. Third, host-country risk-taking is enhanced even further if home-country supervision is inefficient. The results on the other hand imply that if home-country regulation is *strict* and home-country supervision is *efficient*, banks seek to lend more abroad but will "play it safe" by lending to less risky and more transparent firms. This result could be viewed as clarifying findings in the literature that foreign banks "cherry pick" the borrowers that they lend to in host countries (e.g., Berger et al., 2001; Gormley, 2010; Mian, 2006; and Degryse et al., 2009, for a recent survey). Our findings suggest that this phenomenon, however, may depend on the nature of home-country regulation. In this respect, strict home-country regulation and efficient supervision have a positive externality on the availability of host-country credit. Our findings hold when conditioning on a large set of observable firm-level characteristics, the effects are not subsumed in the degree of host-country bank regulation and supervision, and they survive controlling for bank capital strength.

The paper proceeds as follows. Section 2 summarizes the data. Section 3 describes the empirical methodology and the identification strategy. Section 4 presents the initial results on the link between home-country regulation and supervision and host-country lending. Section 5 assesses the relation between home rules and foreign risk-taking. Section 6 discusses how our results relate to the literature, and Section 7 concludes.

2 Data and summary statistics

2.1 Cross-border banks' branches in emerging Europe

We wish to determine how home-country regulation and supervision affects host-country loan provision and risk taking. To that end, we start by building a new database of the geographic presence of large cross-border banks in local host-country markets. We choose a sample of 13 emerging

European markets for which foreign bank presence is particularly relevant and for which we also have firm level data. Next, we determine the set of banks operating in each host country that together hold at least 85% of the banking sector assets in this country. We do so in order to make the matching of banks and firms more manageable by excluding banks with insignificant national presence. This gives us a total of 136 banks for a range of between 4 banks in Estonia and 9 banks in Bulgaria. Out of those, 21 are domestic banks, and 115 are branches or subsidiaries of 23 foreign banks from 12 different home countries. Next, we go through the web sites of all 136 banks in order to determine in which locality each bank is present, and how many branches it has if present. We compile this information for a total of 1,803 localities. This exercise allows us to determine not just which bank is present in which local market, but also its market share at the unit of observation of the locality (city). While we also collect data on domestic banks in the process, in the empirical exercises we focus on those localities in which branches and subsidiaries of foreign banks account for at least 50% of all banks present, or at least 50% of all bank branches. Depending on which of the two criterion is used, we end up with a bank branching map of at least 1,513 localities.

Appendix 1 illustrates the degree of foreign bank penetration in each country in the sample. Clearly, a group of 23 west European and U.S. banks controls the vast majority of assets in the region. These are Erste Group, Hypo Group, Reiffeisen, and Volksbank (Austria), Dexia and KBC (Belgium), Danske Bank (Denmark), Nordea Bank (Finland), Societe Generale (France), Bayerische Landesbank and Commerzbank (Germany), Alpha Bank, EFG Eurobank, Emporiki Bank, National Bank of Greece, and Piraeus Bank (Greece), AIB (Ireland), Intessa San Paolo and UniCredit Group (Italy), ING Bank (Netherlands), Swedbank and Skandinaviska Enskilda Bank (Sweden), and Citibank (U.S.). There is also substantial regional variation in the degree of penetration. For example, the Greek banks operate mostly in south-eastern Europe, the Scandinavian banks in the Baltic countries, and the Austrian banks in central Europe. In addition, there is one domestic "global" bank, the Hungarian OTP, as well as cross-border penetration by, for example, Parex Group - Latvia and Snoras Bank - Lithuania. Appendix 2 lists the coverage in terms of total banking assets in each country. It ranges from 85% in Latvia to 98% in Albania.

Figure 1 presents a map of host countries (where the parent banks are domiciled) and of home-

countries (where the local firms and the branches and subsidiaries of foreign banks operate). The map illustrates our country selection strategy. In terms of host countries, the only markets in emerging Europe that we have excluded are ones where foreign bank presence is limited (like Belarus, Montenegro, or Moldova) or where there are too many banks to make the matching exercise manageable (like Russia or Ukraine). In terms of home countries, some markets where large cross-border banks are domiciled, like Spain, Switzerland, and the UK, are excluded because the presence of banks such as Santander, UBS, and HSBC in the region is very limited. Finally, only ING and Citigroup are present in the region through branches of the parent bank rather than through subsidiaries.

2.2 Bank regulation and supervision

This paper evaluates theoretical predictions that key aspects of domestic bank regulation map into loan provision and risk taking in foreign markets. In selecting from available databases, we use two criteria. First, we analyze regulatory tools which have been highlighted by theory to affect bank behavior. Second, we make sure that we focus on tools which vary sufficiently across the home countries in the sample. Thus, we examine the role of capital regulations, regulatory restrictions, and bank supervision.

The two regulatory databases that we make use of are constructed by Barth et al. (2008) and Abiad et al. (2008). From the former, we use indicators of capital regulation. *Capital stringency* is an index of regulatory constraints on bank capital. This index is based on the following questions: (1) Is the minimum capital asset ratio requirement risk weighted in line with the Basel guidelines? (2) Does the minimum ratio vary as a function of market risk? (3) Are unrealized values of loan losses deducted from capital? (4) Are unrealized losses in securities portfolios deducted? (5) Are unrealized foreign exchange losses deducted? (6) What fraction of revaluation gains is allowed as part of capital? (7) Are the sources of funds classified as capital verified by the regulatory or supervisory authorities? (8) Can the initial disbursement and subsequent injections of capital be executed with assets other than cash or government securities? (9) Can initial disbursement of capital be executed with borrowed funds? Thus, capital stringency does not measure statutory

capital requirements. Instead, it measures the regulatory approach to assessing and verifying the degree of capital at risk in a bank.

We also use the indicator *Restrictions on bank activities* from Barth et al. (2008). This index measures regulatory impediments to banks engaging in: (1) Securities market activities (e.g.,underwriting, brokering, dealing, and all aspects of the mutual fund industry); (2) Insurance activities (e.g., insurance underwriting and selling); (3) Real estate activities (e.g., real estate investment, development, and management); and (4) the ownership of nonfinancial firms. Both indices are also used in Laeven and Levine (2009).

From Abiad et al. (2008), we use two more indices. *Regulatory stringency* is a composite index of regulatory restrictions which includes six separate categories. These categories are: (1) Credit controls and ceilings; (2) Interest rate controls; (3) Entry barriers; (4) Privatization; (5) Restrictions on international capital flows; and (6) Security markets regulation. In turn, the value for each subindex is determined in the following way. "Credit controls and ceilings" is based on the questions: Are there minimum amounts of credit that must be channeled to certain sectors, or are there ceilings on credit to other sectors? Are directed credits required to carry subsidized rates? Is there a ceiling on the overall rate of expansion of credit? How high are reserve requirements? "Interest rate controls" is based on whether deposit interest rates and lending interest rates are determined at market rates, or whether they are set by the government or subject to ceiling/floor. "Entry barriers" is based on the following questions: To what extent does the government allow foreign banks to enter into a domestic market? Does the government allow the entry of new domestic banks? Are there restrictions on branching? Does the government allow banks to engage in a wide rage of activities? "Privatization" is based on the degree to which state-owned banks dominate the domestic market. "Restrictions on international capital flows" is based on the following questions: Is the exchange rate system unified? Does the country set restrictions on capital inflow? Does the country set restrictions on capital outflow? "Security markets regulation" is based on the following questions: Has the country taken measures to develop securities markets? Is the country's equity market open to foreign investors?

Finally, our index of *Prudential supervision* also comes from Abiad et al. (2008). It is based

on the following questions: (1) Has a country adopted a capital adequacy ratio based on the Basle standard? (2) Is the banking supervisory agency independent from executives' influence? (3) Does the banking supervisory agency conduct supervision through on-site and off-site examinations? (4) Does the country's banking supervisory agency cover all financial institutions without exception? This is the only index which captures the degree to which an active agency is involved in the supervision of the banking sector and with the possible exception of the first questions is based on more than the mere counting of existing mechanical regulatory rules.

All regulatory variables are scaled so that higher values indicate a more restrictive regulatory environment. The supervision variable is scaled so that higher values indicate a greater degree of government intervention.

2.3 Bank loan underwriting, bank risk taking, and firm-level characteristics

The data on bank loan underwriting, bank risk taking, and firm-level characteristics come from the 2005 and the 2008 version of the Business Environment and Enterprise Performance Survey (BEEPS) on SMEs. We use two waves of the survey carried out in Spring 2005 and in Spring 2008 among 13,409 firms from 27 countries in central and eastern Europe and the former Soviet Union. The survey response rate was 36.9%. Surveyees who declined to participate or were unavailable for interviews accounted for 38.3% of the original target group. Firms that were ineligible due to the necessity to fulfill industry quotas and firm size quotas accounted for the remainder. We narrow that initial sample down to the countries (as well as localities within these countries) which we already determined to be suitable in terms of sizeable foreign bank penetration. The final sample thus consists of 8,253 firms, observed either in 2005 or in 2008, in 1,513 localities across 13 countries.

The main purpose of the survey is to obtain information from firms about their experience with financial and legal constraints, as well as government corruption. In addition, however, BEEPS also included questions about firm ownership structure, sector of operation, industry structure, export activities, use of external auditing services, subsidies received from central and local governments, etc. Respondent firms come from 6 different sectors: construction; manufacturing (11 sub-sectors); transport; wholesale and retail; IT; and hotels and restaurants. The number of firms covered is

roughly proportional to the number of firms in the country, ranging from 258 in Albania to 1,430 in Poland. The survey tried to achieve representativeness in terms of the size of firms it surveyed: between three quarters and nine tenths of the firms surveyed are "small" (less than 100 workers) and only around 5% of the firms surveyed are "large" (more than 500 workers).[1] The survey also aimed to achieve representativeness in terms of private vs. public firms, firms with access to foreign product markets, firms which receive government subsidies, etc. Table 1 provides the summary statistics on the number of firms and their size, ownership, and other characteristics by country. Appendix 1 explains the construction of all firm-level (as well as industry- and country-level) variables in the data.

For the purpose of measuring bank loan underwriting, we use the information on the firm's most recent experience credit application. Question K16 asks: "Has the establishment applied for any loans or lines of credit?"[2] For firms that answered "No" to K16, Question K17 subsequently asks: "What was the main reason the establishment has not applied for any line of credit or loan?". For firms that answered "Yes" to K16, Question K18a subsequently asks: "Has this establishment applied for any new loans or new credit lines that were rejected?". Firms that answered "No need for a loan" to K17 were classified as firms that do not desire bank credit. Firms that answered "Yes" to K18a or "Interest rates are not favorable", "Collateral requirements are too high", "Size of loan and maturity are insufficient", or "Did not think it would be approved" to K17 were classified as constrained. This strategy of grouping firms that were turned down and firms that were discouraged from applying is standard in studies that rely on detailed questionnaires (see Cox and Jappelli (1993)).[3] Also, it is crucial given our empirical strategy to separate the firms that did not apply for credit because they didn't need it from those that did not apply because they were discouraged. The literature has also suggested to group firms that were turned down and firms that were discouraged from applying are observationally equivalent, and that discouragement is

[1] See http://www.ebrd.com/country/sector/econo/surveys/beeps.htm for further detailed reports on the representativeness of the survey.

[2] Fiscal year 2007 refers to the calender year 2007. However, for tax purposes, in the countries in the sample firms can choose to extend it to March 31, 2008, which is precisely why the Survey was administered in March-April 2008. Given that signs of a credit crunch started emerging right after August 9, 2007, the data gives us at least two and at most three quarters of credit crunch effects potentially experienced by firms.

[3] Using data on central and east European firms, Brown et al. (2011) show that the share of firms discouraged from applying is up to twice as large than the share of firms which applied and had their loan application rejected.

frequently an actual rejection, following a conversation with the loan officer, which does not appear in bank records (see Duca and Rosenthal (1993)). Table 2 presents a summary by country of the shares of firms in need of bank loans and of constrained firms. As the data suggest, fewer firms needed credit in fiscal year 2007 than in fiscal year 2004 (57% vs. 69%), and fewer of the firms that actually applied were turned down (13% vs. 33%). However, this picture is slightly misleading as the question in the 2008 survey asks about fiscal year 2007, while the question in the 2005 survey asks about the firm's experience with the latest loan.

3 Empirical methodology and identification

3.1 Main empirical model

Our goal is to evaluate how home-country regulation and supervision affects host-country loan provision and risk taking. Given the data we have assembled, the immediate approach would be to map regulation into loan rejection and the firm risk associated with granted loans. However, this strategy would fail to account for the changing composition across business lenders of firms that demand bank credit, or in other words, for the fact that the sample of firms that apply for credit is not a random sample of the population of firms.

It is now customary to address this problem by incorporating information on non-applicant firms in a standard 2-step Heckman procedure. The idea is that credit constraints are only observable when a firm has a strictly positive demand for bank credit. Let the dummy variable Q equal 1 if the firm desires positive bank credit and 0 otherwise. The value of Q is in turn determined by the latent variable:

$$q = \zeta \cdot Z_{ijkl} + \varepsilon_{ijkl}$$

where Z_{ijkl} contains firm and location variables that may effect the firm's fixed costs and convenience associated with using bank credit. The variable $Q = 1$ if $q > 0$ and $Q = 0$ otherwise. The error ε_{ijkl} is normally distributed with mean 0 and variance σ^2. The second stage regression can now be updated by adding the term $\sigma \frac{\phi(q)}{\Phi(q)}$ to the RHS, where $\frac{\phi(q)}{\Phi(q)}$ is the inverse of Mills' ratio

(Heckman, 1979). Identification rests on the exclusion restriction which requires that q has been estimated on a set of variables that is larger by at least one variable than the set of variables in the second stage.

Thus, in the second stage regression in which we determine the effect of domestic regulation and supervision on loan granting in foreign markets, we thus estimate the following model:

$$Y_{ijklt} = \beta_1 \cdot X_{ijklt} + \beta_2 \cdot \mathrm{Re}\, g_{jkt} + \beta_3 \cdot D_k + \beta_4 \cdot D_l + \beta_5 \cdot D_t + \beta_6 \sigma \frac{\phi(q)}{\Phi(q)} + \varepsilon_{ijkl} \qquad (1)$$

where Y_{ijklt} is a dummy variable equal to 1 if firm i in city j in country k in industry l in year t is credit constrained; X_{ijklt} is a matrix of firm characteristics; $\mathrm{Re}\, g_{jkt}$ is a measure of home-country bank regulation of the banks whose branches and subsidiaries are active in city j in country k; D_k is a matrix of country dummies; D_l is a matrix of industry dummies; D_t is a matrix of year dummies; and ε_{ijkl} is an idiosyncratic error term. The firm-level co-variates control for observable firm-level heterogeneity. The three sets of dummy variables control for any unobserved market, industry, and business cycle variation. Essentially, they eliminate the contamination of the estimates by time-invariant sectoral characteristics, like growth opportunities; by time-invariant macroeconomic factors, like taxes or domestic regulation; and by global time-varying developments, like the credit cycle.

In the second stage regression in which we determine the effect of domestic regulation and supervision on risk-taking in foreign markets, we estimate the following model:

$$Y_{ijklt} = \beta_1 \cdot X_{ijklt} + \beta_2 \cdot \mathrm{Re}\, g_{jkt} \cdot Risk_{ijklt} + \beta_3 \cdot D_k + \beta_4 \cdot D_l + \beta_5 \cdot D_t + \beta_6 \sigma \frac{\phi(q)}{\Phi(q)} + \varepsilon_{ijkl} \qquad (2)$$

where $Risk_{ijklt}$ is a measure of the ex-ante riskiness and opacity of firm i in city j in country k in industry l in year t is. We define firms to be risky if they are, alternatively, small firms, firms with unaudited financial statements, nonexporters, or innovative firms.[4] The independent effect of

[4] Thus, our proxies for risk taking capture both opacity and risk. While being unaudited, for example, is specifically an opacity measure, the other three measures are all proxies for both risk and opacity. We also focus on ex-ante riskiness. An opaque firm, for example, is risky only ex-ante in the sense that its risk is unobserved, but ex-post it

these variables is already subsumed in the matrix X_{ijklt}.

The main parameter of interest in all three models is β_2, which measures the effect of home-country regulation and supervision on host-country lending. We construct the home-country bank regulation index by aggregating data on home-country regulation and supervision after determining which banks are present in each locality in each host country, as well as the parent bank of each bank in each locality in each host country. The underlying assumption in the absence of a direct match of each loan to the lending bank and of each rejection to the rejecting bank is that if firms were granted/denied credit, then it was most likely the result of interaction with banks in the firms' locality of incorporation. We use two different weighting criteria in constructing the index, namely, giving equal weight to each bank in that particular locality, or weighting each bank's home-country regulation and supervision by the number of branches it has in the locality.

Here is an example to clarify the above procedure. There are 4 banks in Estonia that hold close to 100% of the banking assets in the country: Swedbank, SEB, Sampo Pank, and Nordea. They are subsidiaries of Swedbank - Sweden, SEB - Sweden, Danske Bank - Denmark, and Nordea - Finland. In 2008, our index of prudential supervision from Abiad et al. (2008) takes on the value of 2 in Sweden, 3 in Denmark, and 1 in Finland. Consider the city Lihula in which only Swedbank has branches. We assign the prudential supervision index a value of 2 in Lihula, and then we match this index of home-country bank supervision to all firms incorporated in that city. Consider alternatively the city of Kuresaare, in which Swedbank, SEB, and Nordea are present. They have 2, 1, and 1 branches in that city, respectively. Consequently, in the main analysis, where we assign equal probability of each firm in that city doing business with each bank present in that city, we assign the prudential supervision index a value of $\frac{5}{3} = \frac{1}{3} \cdot 2 + \frac{1}{3} \cdot 2 + \frac{1}{3} \cdot 1$, which is then matched to all firms located in Kuresaare. And in the exercises where we weigh the probability of each firm doing business with each bank present in Kuresaare by the number of that bank's branches in that locality, we assign the prudential supervision index a value of $\frac{7}{4} = \frac{1}{2} \cdot 2 + \frac{1}{4} \cdot 2 + \frac{1}{4} \cdot 1$.

This procedure gives us considerable variation of our main financial variables of interest within each country, due to the fact that not all banks present in a country are present in each city,

is not necessarily (or even on average) riskier than other firms whose risk is observable.

and whenever they are, not to the same extent. For example, in the 2008 sample of firms, there are 1,102 localities in the 13 countries in the sample, characterized by 66 unique values of the index of city-specific home-country regulation, when data on all banks in a locality are weighted equally, and by 351 unique values of city-specific home-country regulation when data on all banks is branch-weighted. Consequently, there is little reason to worry that the country fixed effects in the regressions capture the same variation as locality-specific regulation and supervisory strength. Importantly, identification is achieved not by comparing bank lending behavior and risk-taking across countries, but across localities within countries, where the country effect is swept out by country dummies.

Finally, we need to emphasize that throughout the paper, it is implicitly assumed that the effect of bank financial distress is localized and realized predominately by firms headquartered in the locality in which the bank has operations. All our empirical specifications presume that firms borrow from banks located near their address of incorporation, which is identical to the approach in, for example, Gormley (2010). In general this is expected to hold as banks tend to derive market power ex ante from geographical proximity (e.g., Degryse and Ongena, 2005). Providing support to that conjecture, empirical work regarding lending relationships in different countries has demonstrated that the average distance between SMEs and banks is usually very small. For example, Petersen and Rajan (2002) find that the median distance between a firm and its main bank in the US over the 1973-1993 period was only four miles.

3.2 First stage regressions

Table 4 presents the results from the first stage probit regression of the Heckman correction procedure. The probability of positive demand for bank credit is generally lower for firms in localities dominated by foreign banks from countries with stricter regulatory restrictions and more efficient bank supervision. In several cases, this effect is also statistically significant at the 10% level. For example, in a locality with prudential supervision at the 75th percentile of efficiency, the typical firm exhibits, *ceteris paribus*, a 4.1% lower probability that it would have a positive demand for bank credit than were it incorporated in a locality with prudential supervision at the 25th per-

centile of efficiency.[5] This implies that along the regulatory and supervisory dimension, localities may differ systematically in the type of firms that inhabit them. This could be because the industrial composition in localities dominated by banks domiciled in countries with more efficient supervision is skewed towards sectors that for technological reasons do not need much external finance. Alternatively, banks from countries with tighter regulation may have endogeneously chosen to enter through branching networks that serve bank-dependent firms. Not accounting for such selection mechanism would thus bias the estimates of the effect of regulation on loan provision and risk-taking towards zero.

In terms of firm-level co-variates, the demand for bank credit increases in the size of the firm. One potential explanation is that small firms face higher application costs (Brown et al., 2011). Also, in a beginning-of-a-recession environment it might be that small firms are better equipped to finance investment with cash flows than - potentially - more highly leveraged large firms. In addition, some of the size effects may be picked by ownership and structural characteristics, as sole proprietorships have a higher demand for loans. The probability of desiring credit is higher for exporters potentially due to their faster expansion, and is lower for non-audited firms, which might simply imply that firms choose to be audited (i.e., they are willing to pay for transparency) when they plan to apply for bank credit.[6] It may also be the case that audited firms have access to financial statement lending which may be a cheaper lending technology (Berger and Udell, 2006). Finally, innovative firms tend to have a lower demand for credit.

In terms of the exclusion restriction, the variables "Competition" and "Subsidized" are included in this demand model, but excluded from the rest of the exercises. The rationale for using these particular variables as instruments for demand is the following. Firms in more competitive environments will likely have a higher demand for external credit due to lower profit margins, but it is unlikely that credit decisions will be correlated with product market competition. Analogously, having applied for state subsidies is likely a signal for external financial need. These considerations make both variables good firm demand shifters. Both variables are very positively correlated with

[5] All percentage differences that are reported are calculated using the marginal effect at the sample mean.

[6] The results are broadly consistent with Ongena and Popov (2011) who apply a double selection technique to the BEEPS 2005 sample.

the demand for loans, and the effect is statistically significant at the 1% level. The F-statistics from a first-stage regression of loan demand on the two variables (unreported) is 39.01 and 42.08, for different weighting of home-country regulation and supervision, which satisfies the validity test.

Finally, due to information limitations in the data we only use 6,357 firms in these regression rather than the 8,253 reported in Table 1. This is because in Table 4 and on, we focus on firms in localities dominated by foreign banks. We thus lose information on 519 firms when we weigh the regulatory and supervisory variables by banks present, and 887 firms when we weigh the regulatory and supervisory variables by the number of branches of each bank present. The remaining part of the reduction is accounted for by the firms which are incorporated in localities for which no data on bank presence are available.

4 Home-country regulation and supervision and host-country lending

We start the main part of our empirical analysis with the estimation of Model (1) in which we study how the stringency of home-country regulation and the efficiency of home-country supervision is mapped into host-country loan provision. The regressions presented in Table 5 suggest that stricter home country regulation and less efficient home-country supervision are associated with lower rejection rates by cross-border banks in foreign markets.

In line with our identification strategy, we include country and time fixed effects in each of the regressions, and in addition the standard errors are adjusted to control for clustering at the country level. All six regressions control for a host of firm-level characteristics included in Table 4, with the exception of "Competition" and "Subsidized" whose omission from the regressions is meant to satisfy the exclusion restriction. The estimates of the regression coefficients on the non-excluded firm-level variables imply that small firms, sole proprietorships, unaudited firms, non-innovative firms, and non-exporting firms tend to be more constrained in credit markets. These results are broadly in line with findings in the literature on SME lending that foreign banks cherry-pick (e.g., Berger et al., 2001; Mian, 2006; Gormley, 2010), as well as on the literature of how credit constraints

vary with firm characteristics (e.g., Beck et al., 2005).

In Column (1), we use the composite index of regulatory stringency from Abiad et al. (2008). This is an index comprised of purely mechanical rules, that is, it emphasizes the rule-book approach to regulation and supervision rather than the enforcement approach. The negative sign of the regression estimate implies that stricter home-country regulation is associated with lower host-country rejection rates. In panel B where we construct the locality-wide index of regulation by weighting by number of branches the information on home-country regulation for all banks present, the coefficient is also statistically significant. Its magnitude implies that within the same country, a typical firm operating in a locality dominated by banks with the regulatory stringency of the Italian bank market has a 6.1% higher probability of having its loan application rejected than a typical firm operating in a locality dominated by banks with the regulatory stringency of the Austrian bank market. Recall that our identification strategy is based on a cross-locality within-country test rather than a cross-country test, so we are not comparing rejection rates in country X, dominated by Italian banks, and country Y, dominated by Austria banks. The 6.1% rejection rate differential is rather calculated by comparing, within the same country, two cities served by banks from different regulatory environments - for example, the Romanian town of Huedin (regulatory stringency value of 0.5) and the Romanian town of Megdidia (regulatory stringency of 1.5).

In Column (2), we look at the effect on lending of the index of prudential supervision from Abiad et al. (2008). We observe that higher government involvement in supervision has the opposite effect to higher government involvement in regulation. Specifically, the positive sign of the regression estimate implies that a more efficient home-country supervision is associated with higher rejection rates. In panel A where we construct the locality-wide index of regulation by weighing equally the information on home-country regulation for all banks present, the coefficient is also statistically significant at the 5%. To use the same example as before, the magnitude of the coefficient implies that within the same country, a typical firm operating in a locality dominated by banks with the efficiency of the Italian bank supervisor has a 12.2% lower probability of having its loan application rejected than a typical firm operating in a locality dominated by banks with the efficiency of the Austrian bank supervisor. The combined evidence implies that banks which are at

home subject to higher regulatory stringency, but also to less efficient supervision, tend to extend more credit to an identical population of firms abroad. This evidence is fairly consistent with the idea that strict regulation and inefficient supervision at home may incentivize cross-border banks to search more actively for profit abroad.

In Columns (3) and (4), we check the effect of two other indices of regulation and supervision on bank lending, the indices of restrictions on bank activities and of capital stringency from Barth et al. (2008). These two turn out to have a statistically insignificant effect on bank lending, and their sign switches across specifications depending on how we weigh the information on all banks present in calculating the locality-specific indices on regulation and supervision.

In Column (5), we perform a horse race of all the regulatory and supervisory indices we have at hand. This approach allows us to juxtapose rule-based regulation and activity-based supervision, and study whether they have an independent effect on bank lending in foreign markets, or the effect of one is subsumed in the effect of the other. We find that both matter simultaneously. The positive effect of efficient supervision on rejection rates, uncovered in Panel A, survives the inclusion of indices for rule-based regulation, and the negative effect of stricter regulation on rejection rates is undiminished by accounting for supervision.

Finally, in Column (6) we perform the same horse race, but we also include the inverse of Mills' ratio estimated in the regressions reported in Table 4. The coefficient on the selection term implies a negative correlation between unobservables in the equation for bank credit desirability and those in the loan provision equation. This negative correlation implies that unobserved factors that increase the demand for a bank loan tend to increase the probability of obtaining one. In this specification, the effect of prudential supervision on the probability of loan rejection, albeit still positive, is marginally insignificant. At the same time, the positive effect of home-country regulation on host-country loan provision becomes significant regardless of how we construct the locality-specific index of regulation. Therefore, the horse race coupled with accounting for selection bias implies that stricter home-country regulatory stringency may to a larger degree incentivize banks to look for profit abroad than less efficient home-country supervision.

5 Home-country regulation and supervision and host-country risk-taking

5.1 Main result

In the previous section we established a link between the stringency of home-country regulation (and to some extent the inefficiency of home-country supervision), on the one hand, and the granting of loans in the host country, on the other hand. However, we do not know yet how these loans are allocated, interms of risk and opacity, for example. It is possible that banks domiciled in more tightly regulated markets extend more loans indiscriminately, or that they increase loan provision predominantly to riskier firms, in search of the high-risk type of growth, or that they mostly lend to the population of safe firms. Therefore, we cannot so far distinguish between theories about the effect of domestic regulation and supervision on risk-taking in foreign markets. This question is crucial in determining whether domestic regulation and supervision is associated with a positive or with a negative externality in terms of risk-creation. The previous section suggests that such an externality may exist.

We now proceed with the estimation of Model (2) in which we study how the stringency of home-country regulation and the efficiency of home-country supervision is mapped into risk-taking by cross-border banks in host-country markets. The overarching message from the regressions presented in Table 6 is that stricter home-country regulation and (to a lesser degree) less efficient home-country supervision is associated with higher rejection rates of small, opaque, and innovative firms. The evidence thus implies that stricter regulatory rules and incentivize banks to expand credit provision abroad in the search for profit, such banks mostly expand credit availability among relatively safe corporate clients. Put alternatively, cross-border banks tend to engage in risk-taking in foreign markets when they are less tightly regulated at home. Lax domestic bank regulation (and to a lesser degree efficient domestic bank supervision) seems to be associated with a negative externality in terms of cross-border risk-creation.

Looking at the evidence itself, in Columns (1) and (5) we interact the index of regulatory stringency from Abiad et al. (2008) with an indicator variable equal to 1 if the applicant firm is

small (fewer than 100 employees). The estimate of the direct effect of regulation on loan provision continues to imply that stricter regulation results in higher loan availability. The results, however, also indicate that the impact of regulatory stringency on the probability of accepting a loan application depends on the size of the corporate client applying for a bank loan. The interaction term enters positively and statistically significantly the regression. Consistent with standard approaches to bank regulation, the sign of the effect implies that higher regulatory stringency domestically reduces risk-taking in foreign markets. A small firm has a between 5.6% and a 6% higher probability of having its loan application rejected if it is dealing with banks at the 75th percentile of the sample domestic regulatory stringency relative to an identical firm in the same country dealing with banks at the 25th percentile of the sample domestic regulatory stringency.

In Columns (2) and (6) we perform the same exercise, where firm-level opacity is proxied by whether the firm is audited or not. We find the exact same result: While the estimate of the direct effect of regulation on lending implies that stricter regulation results in higher loan availability, the interaction term between bank regulation and firm opaqueness enters positively and statistically significantly in the regression. To the extent that informationally opaque firms are ex-ante riskier, the sign of the effect implies that higher regulatory stringency domestically reduces the incentives of banks to extend loans to such firms in foreign markets. An opaque firm has a between 5.3% and a 5.6% higher probability of having its loan application rejected if it is dealing with banks at the 75th percentile of the sample domestic regulatory stringency relative to an identical firm in the same country dealing with banks at the 25th percentile of the sample domestic regulatory stringency.

In Columns (3) and (7), firm-level risk is proxied by whether the firm has access to foreign markets or not. To begin with, it is unclear whether in this case higher risk is implied by a value of 0 or by a value of 1. Exporting firms may be riskier if their profit stream is sensitive to shocks to foreign demand. Alternatively, foreign demand may be more stable than domestic demand, or differently put, such firms may experience higher growth for the same level of demand volatility. The independent effect of being an exporter on loan rejection rates is negative, implying that banks in general prefer to extend credit to firms which, *ceteris paribus*, sell their products

in foreign markets. The interaction with bank regulation, but also with bank supervision, enters negatively in the regressions, as well as significantly in at least one case. Given that in most of our exercises tight domestic regulation seems to be the mirror image of light domestic supervision, the evidence on their impact on risk-taking in foreign markets is inconclusive. If we choose to focus on the effect of regulation, in order to build upon the results from the previous exercises, we can report that stricter domestic regulation tends to make banks more willing to lend to exporting firms in foreign markets. To the extent that exporting tends to be associated with "good" rather than with "risky" growth prospects as only the most productive firms engage in foreign activities (Helpman et al., 2004), the evidence continues to imply that stricter domestic regulation reduces risk-taking abroad.

Finally, in Columns (4) and (8) we proxy firm risk with whether the firm is an innovative one (i.e., whether it has introduced a new product in the past 3 years). Innovative firms can be viewed as risky, especially if they operate in industries where innovation is R&D- and intangibles-intensive and thus there are few collateralizeable assets to be pledged against a bank loan. Thus our innovation variable likely mirrors R&D which has been frequently used to proxy for risk and informational opacity (e.g., Bhagat and Welch, 1995; Coles et al., 2006; Ashcraft and Santos, 2007). In this exercise, we again confirm that tight regulatory rules affect banks' incentives in the same way inefficient supervision does. In particular, the two variables that enter the regressions significantly, are the composite index of regulatory stringency from Abiad et al. (2008) and the index of capital stringency from Barth et al. (2008). The latter index is more supervision-like in that it measures the regulatory approach to assessing and verifying the degree of capital at risk in a bank rather than a set of rules. Higher values of the regulatory stringency index and lower values of the capital stringency index are associated with lower loan rejection rates. The interaction terms with the index of whether the firm is innovative enter with the opposite sign. This once again implies that the over-and-above increase in loan provision induced by stricter domestic regulation and inefficient domestic supervision has mostly affected firms with more conservative product lines. Therefore, the increase in lending in foreign markets induced by these types of domestic regulation and supervision seems to have been characterized by a flight away from risk.

5.2 Interaction between supervision and regulation

Some authors have argued that the effect of strict regulation may vary with the strength of the bank supervisor. For example, restrictions on bank activities may be relatively more desirable in environments where the public sector lacks the ability to monitor banks because of inefficient official supervision. Similarly, capital regulations may be especially important in countries with a regulatory environment that does not spur private monitoring (see Barth et al., 2004, for an exposition of these arguments). Alternatively, powerful supervisors may have an incentive to undertake socially sub-optimal actions. This situation may arise if there are agency problems between taxpayers and bank supervisors, for example when supervisors are self-interested and there is uncertainty about their ability to monitor banks, as in Boot and Thakor (1993). If this is the case, then strict regulation will limit the instability consequences of powerful and efficient supervision.

To test these hypotheses, we examine whether the effect on bank host-country risk-taking of regulating banks more strictly in home markets depends on the degree of home-country supervision. In particular, we have now added to our Model 2 three triple interaction terms: Regulatory stringency × Prudential supervision × Risk, Restrictions on bank activities × Prudential supervision × Risk, and Capital stringency × Prudential supervision × Risk, where as before, risk/opacity is a dummy variable equal to 1 if the firm is small, unaudited, non-exporting, or innovative.[7] A negative coefficient would imply that various types of home-country regulatory restrictions are more effective in restricting host-country risk-taking (in the sense of extending loans to ex-ante risky and/or opaque corporate clients) when home-country supervision is less efficient. Conversely, a positive coefficient would imply that strict regulation and efficient supervision are complements in enhancing bank stability.

The estimates of this expanded model are reported in Table 7. The evidence points to complementarities between regulation and supervision, in that the estimates of the coefficeints on the interaction effects are generally positive and in several cases significant. For example, general regulatory stringency reduces host-country risk-taking relatively more if banks are more efficiently

[7] The regression also includes all possible double interaction terms between each of the three regulatory variables, prudential supervision, and each proxy for risk.

supervised in home markets when risk-taking is proxied by extending loans to small firms (Column (1)) and to non-exporting firms (Column (3)). Similarly, restricting bank activities reduces host-country risk-taking relatively more if coupled with more efficient home-country supervision when risk-taking is proxied by lending to unaudited firms (Column (2)) and to non-exporting firms (Column (3)). Finally, higher home-country capital stringency is relatively more efficient in reducing host-country risk-taking if banks are more efficiently supervisied in home markets when risk-taking is proxied by extending loans to unaudited firms (Columns (2) and (6)).

5.3 Accounting for the effect of bank balance sheets

Variation in home-country regulation is by far not the only possible explanation for the variation in host-country risk-taking. The strength of the banks' balance sheet can obviously affect bank lending behavior independently of regulatory rules and supervisory efficiency.[8] The bank lending channel has been studied extensively (e.g., Kashyap and Stein, 2000), and banks have been found to rely heavily on the use of internal capital markets in order to dampen domestic liquidity shocks (e.g., Stein, 1997; Houston et al., 1997). The U.S. credit crunch in 1990-92 and banking crises around the world have spawned a large literature on the real effects of bank internal capital markets.[9] More importantly for our study, the cross-border dimension of the bank balance sheet channel has also been investigated. For example, Peek and Rosengren (1997) show that the decline in Japanese parents' risk-based capital ratio translated into a significant decline in total loans by the U.S. subsidiaries in the 1990s. Chava and Purnanandam (2009) and Schnabl (2011) use the exogenous shock provided by the Russian crisis of 1998 to study the effect on lending to U.S. and Peruvian borrowers, respectively. Cetorelli and Goldberg (2008) and De Haas and van Lelyveld (2010) show that the existence of internal capital markets with foreign bank affiliates contributes to an international propagation of domestic liquidity shocks to lending by affiliated banks abroad. In the context of the 2007-08 crisis, Puri et al. (2010) test the effect of deteriorating balance sheets

[8] While regulation and supervision affect bank fragility directly (through, for example, minimum capital requirements), two banks which conform to the same capital standards may behave differently if their balance sheets are of different strength.

[9] For some empirical investigations of the bank balance sheet channel, see Bernanke and Lown (1991), Berger and Udell (1994), Peek and Rosengren (1995), Woo (1999), Kang and Stulz (2000), Khwaja and Mian (2008), and Jimenez et al. (2011).

of German banks exposed to US asset shocks on lending to domestic retail customers, and Popov and Udell (2010) present evidence that the capital crunch in large European banks begot a credit crunch by their subsidiaries in emerging Europe in the early stages of the crisis.

Therefore, it is important to account explicitly for the independent effect of bank balance sheet strength. We do so in Table 8 where we include interaction of parent bank capitalization (essentially, the Tier 1 capital ratio for parent banks, weighted equally or by number of branches for all subsidiaries present in a particular locality) with firm risk/opacity. We confirm that balance sheet strength has an independent effect on risk-taking: Banks with lower Tier 1 capital ratios extended more loans to unaudited (Columns (2) and (6)) and non-exporting (Columns (3) and (7)) firms. Importantly, our main results on the reduction in host-country risk-taking resulting from stricter home-country regulation survives when risk-taking is proxied by lending to small, unaudited, and innovative firms.

6 Discussion of results

There is a large literature on the role of government in regulating economic activity (Pigou, 1938; Stigler, 1971). One of the prime targets of such regulation are commercial banks because their risk-taking behavior has important implications for financial and economic fragility (Bernanke, 1983; Calomiris and Mason, 1997, 2003a,b). To that end, various domestic regulatory and supervisory agencies have been charged with the task to monitor and assess bank risk. The construction of databases containing indices of regulatory stringency and supervisory structure has enabled researchers to look into how the actions of these agencies have affected various banking developments. For example, Barth et al. (2004) show that restrictions on bank activities affect negatively bank development, while capital regulations enhance bank stability. Laeven and Levine (2009) show that capital requirements and capital stringency reduce risk-taking by banks, and also that this effect depends crucially on the bank's ownership structure.

Our evidence suggests that to different degrees, these results extend across borders. For example, we find that higher restrictions on bank activities in home countries lead cross-border banks to

extend more loans to opaque corporate clients in host-country markets (Table 6, Column (6)). To the extent that informational opacity is associated with higher ex-ante risk, this result suggests an increase in risk-taking abroad following higher restrictions on bank activities at home. This is consistent with theories implying that fewer regulatory restrictions increase the franchise value of banks and therefore augment incentives for more prudent behavior (see Barth et al., 2004). This result is also consistent with prior empirical evidence indicating that restricting bank activities has negative repercussions. For example, Barth et al. (2001) find that such restrictions are associated with a higher probability of a major banking crisis and lower banking-sector efficiency. However, prior evidence has only documented the domestic dimension of this effect. Our results suggest that restrictions on bank activities domestically may lead to risk-taking abroad - potentially to compensate for the inability to perfectly diversify in home markets.

Our results also suggest that higher capital stringency in home countries leads cross-border banks to extend more loans to innovative firms (firms that introduce at least one new product line every three years) in foreign markets (Table 6, columns 4 and 8). It is theoretically ambiguous if innovative firms are more or less risky customers. However, Table 5 suggests that, *ceteris paribus*, innovative firms face statistically higher rejection rates. Therefore, it seems that the banks in our sample tend to treat innovative firms as riskier. In that sense, the lower rejection rates of innovative firms by banks domiciled in markets with more stringent capital requirements implies that these banks may be making up abroad for the inability to engage in high risk-high return lending at home. Barth et al. (2004) and Laeven and Levine (2009) both show that capital requirements decrease bank riskiness and the share of non-performing loans. Our results imply that lending in foreign markets is a mirror image of domestic behavior. However, in both the case of restrictions on bank activities and in the case of capital requirements, the evidence is not consistent across the range of proxies for risk-taking, and so it is suggestive rather than conclusive.

Our most consistent result is that higher regulatory restrictions result in *more loans* being extended to *predominantly safe* corporate clients in foreign markets. This implies that tighter regulation at home induces cross-border banks to act conservatively in foreign markets. To the extent that most of the cross-country variation in this index comes from the degree of involvement

of state-owned banks and from barriers to entry, this evidence is consistent with theories of the beneficial effect of competition in enhancing prudent risk-taking behavior, as well as theories arguing that governments do not have sufficient incentives to ensure socially desirable outcomes (see Shleifer and Vishny, 1998, for an extensive treatment of both arguments). Our evidence seems to go against the argument in Gerschenkron (1962) that governments have adequate information and incentives to invest in strategically important projects, as well as against the argument in Keeley (1990) that banks with monopolistic power possess greater franchise value, inducing them to behave prudently.

Finally, we also find that more efficient domestic supervision is associated with lower lending propensity in foreign markets (Table 5, Panel A, Columns (2) and (5)), but that most of the loans approved are allocated to exporter firms (Table 6, Column (7)). To the degree that, all else equal, exporter firms are less constrained (therefore, less risky) in the sample (Table 5), this evidence suggests that banks which are more efficiently supervised at home engage in a safer lending strategy in foreign markets. This confirms previous arguments that efficient official supervision prevents banks from engaging in excessive risk-taking behavior, thus improving their performance and stability. However, the evidence is observed only for one proxy for risky lending, and therefore, consistent with Barth et al. (2004), we can conclude that the features that constitute official "core" domestic supervision are not strongly associated with bank risk-taking in foreign markets.

In general, our results also offer insights into the role of foreign banks in emerging markets. Overall, the effect of foreign banks on business lending in the literature is ambiguous. A large literature has found that foreign bank presence is associated with higher access to loans (Clarke et al., 2006), higher firm-level sales (Giannetti and Ongena, 2009), and lower loan rates and higher firm leverage (Ongena and Popov, 2011). On the other hand, Berger et al. (2001), Mian (2006), and Gormley (2010) show that foreign banks tend to finance only larger, established, and more profitable firms. Our paper adds to this line of research by providing evidence that foreign banks tend to modify their loan portfolio in response to shocks to bank regulation in home-country markets.

Managerial issues might also be important here given the challenges associated with cross border banking (e.g., Berger et al., 2000). Managerial focus on solving problems at the headquarters level in the home country could reduce the ability of the parent bank to monitor lending activities in its

foreign facilities. Given the organizational frictions associated with lending a la Stein (2002), this reduced monitoring ability could have a disproportional effect on credit availability. Our finding that riskier borrowers are more affected might even suggest a link to the institutional memory explanations of pro-cyclical lending behavior (e.g., Berger and Udell, 2004) where eroded lending expertise is more problematic at foreign banks.

7 Conclusion

In this paper, we conduct the first empirical assessment of theories that relate lending and risk-taking by cross-border banks in foreign markets to domestic bank regulation and supervision. Theory yields inconclusive predictions: strict domestic regulation may incentivize banks to engage in less (act "as if at home") or in more (make up for the lack of risk-taking domestically) risk-taking abroad. We assess these questions by first mapping the scope of the operations of large cross-border banks in 1,513 localities in 13 countries in emerging Europe, and then study how the loan granting process involving corporate clients with various risk profiles relates to the degree of regulation and supervision in the banks' home countries. By employing a cross-locality within-country empirical strategy, we partially address the problem with the endogeneity of foreign bank entry. By using data on local corporate clients to define risk-taking we address the problem that standard measures of bank riskiness, like the Z-score (e.g., Laeven and Levine, 2009), poorly capture the foreign component of the risk-taking behavior of large multinational banks.

We find that loan incidence is lower in localities dominated by foreign branches and subsidiaries of banks domiciled in countries with lower regulatory stringency. Second, this lower lending propensity is associated with the granting of loans primarily to riskier corporate clients, such as small, informationally opaque, and innovative firms. This effect is stronger when home-country supervision is inefficient. Taken together, our findings imply that banks tend to look for safer growth abroad if they are restricted from risk taking in domestic markets. Our findings hold when conditioning on a large set of observable firm-level characteristics, the effects are not subsumed in the degree of host-country bank regulation and supervision, and they hold independently of the effect

of bank balance sheet strength on lending. This evidence is moderately supportive of theories which argue that strict regulation in the home country induces cross-border banks to act accordingly and conservatively abroad. Our results thus seems to suggest that lax domestic bank regulation has important negative externalities through the channel of risk-taking abroad by cross-border banks.

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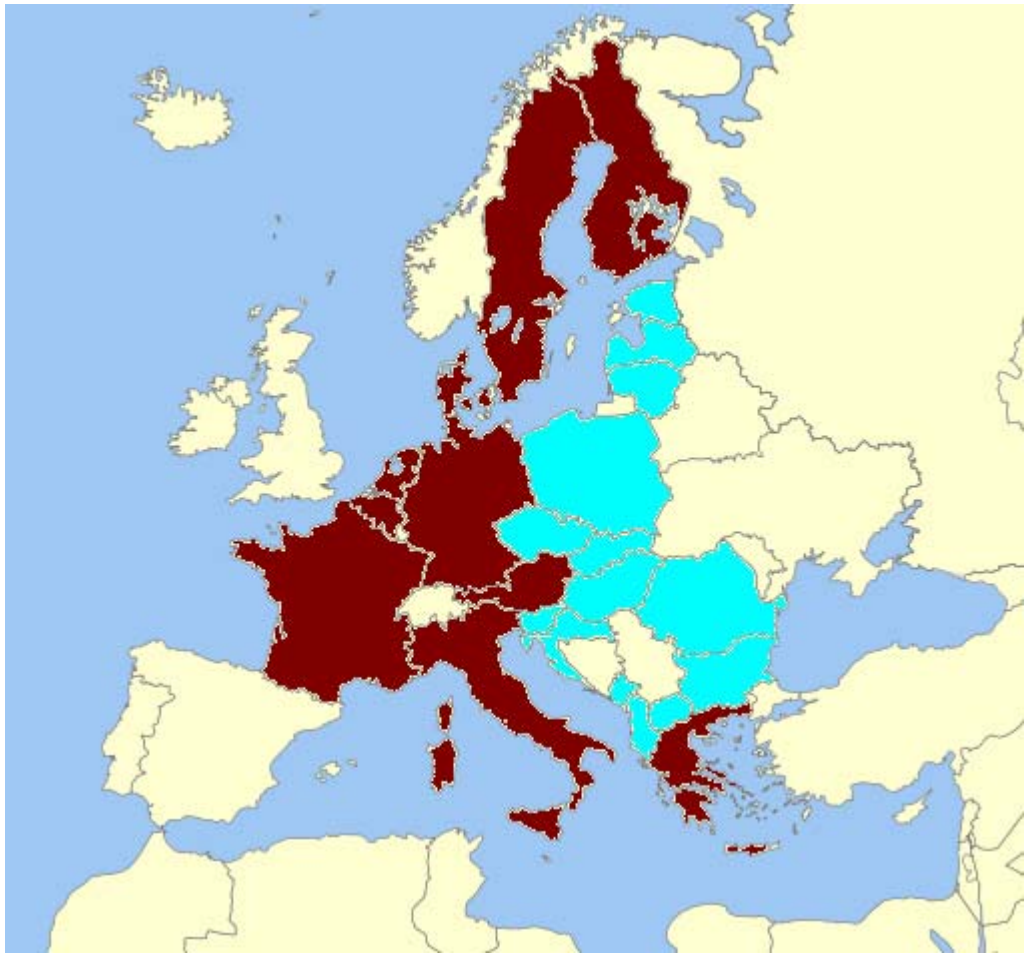
Figure 1. Origin and target countries in the data



The map shows the cross-border dimension of the underlying data. Countries in dark color (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Netherlands, and Sweden) are the home countries in which the parent banks in the dataset are incorporated. Countries in light color (Albania, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Macedonia, Poland, Romania, Slovakia, and Slovenia) are the host countries where the firms in the dataset are incorporated.

Table 1.
Summary statistics: Firm characteristics

Country	# Firms	Small firm	Big firm	Public company	Sole pro-prietorship	Privatized	Non-exporter	Opaque	Firm age	Innovative	Subsidized	Competition
Albania	258	0.90	0.03	0.01	0.74	0.06	0.69	0.26	10.43	1.62	0.04	0.74
Bulgaria	581	0.84	0.03	0.05	0.51	0.12	0.76	0.58	15.89	1.62	0.06	0.62
Croatia	340	0.79	0.05	0.06	0.44	0.23	0.64	0.53	23.06	1.51	0.18	0.79
Czech Republic	593	0.79	0.04	0.04	0.41	0.08	0.65	0.57	13.10	1.63	0.16	0.82
Estonia	492	0.79	0.03	0.13	0.27	0.11	0.66	0.20	14.79	1.52	0.14	0.77
Hungary	901	0.80	0.04	0.01	0.63	0.12	0.64	0.26	14.84	1.67	0.22	0.88
Latvia	476	0.72	0.04	0.01	0.36	0.12	0.69	0.31	14.47	1.49	0.11	0.78
Lithuania	481	0.77	0.02	0.02	0.24	0.16	0.63	0.60	14.29	1.40	0.15	0.78
Macedonia	566	0.81	0.03	0.05	0.32	0.16	0.61	0.46	17.41	1.48	0.04	0.84
Poland	1,430	0.83	0.02	0.05	0.78	0.09	0.74	0.63	17.96	1.58	0.13	0.84
Romania	1,141	0.73	0.04	0.04	0.17	0.13	0.80	0.63	14.43	1.61	0.09	0.71
Slovakia	495	0.74	0.05	0.06	0.54	0.11	0.66	0.45	14.54	1.56	0.13	0.79
Slovenia	499	0.74	0.05	0.08	0.29	0.21	0.44	0.57	23.02	1.52	0.22	0.79
Total	8,253	0.79	0.04	0.05	0.46	0.12	0.68	0.49	16.08	1.57	0.13	0.79

Note: The table presents statistics on the number of firms and the share of firms by size, ownership, privatization history, access to foreign product markets, access to international auditing, subsidies from central and local governments, and degree of competition, by country. 'Small firm' is a dummy equal to 1 if the firm has from 2 to 49 employees. 'Big firm' is a dummy equal to 1 if the firm has more than 250 employees. 'Public company' is a dummy equal to 1 if the firm is a shareholder company, or its shares traded in the stock market. 'Sole proprietorship' is a dummy equal to 1 if the firms is a sole proprietorship. 'Privatized' is a dummy equal to 1 if the firm is a former state-owned company. 'Non-exporter' is a dummy equal to 1 if the does not have access to foreign markets. 'Opaque' is a dummy equal to 1 if the firm does not employ external auditing services. 'Firm age' is the firm's age in years. 'Innovative' is a dummy equal to 1 if the firm has introduced a new product line in the past 3 years. 'Subsidized' is a dummy equal to 1 if the firm has received subsidies during the last 3 years from central or local government. 'Competition' is a dummy equal to 1 if the firm faces fairly, very, or extremely strong competition. Omitted category in firm size is 'Medium firm'. Omitted category in firm ownership is 'Private company'. See Appendix 1 for exact definitions and data sources.

Table 2.
Summary statistics: Credit demand and access

	2005		2008	
Country	Need loan	Constrained	Need loan	Constrained
Albania	0.68	0.30	0.29	0.47
Bulgaria	0.65	0.36	0.58	0.52
Croatia	0.78	0.14	0.59	0.42
Czech Republic	0.56	0.41	0.53	0.32
Estonia	0.60	0.23	0.54	0.27
Hungary	0.78	0.28	0.41	0.31
Latvia	0.70	0.29	0.59	0.47
Lithuania	0.71	0.30	0.60	0.23
Macedonia	0.68	0.56	0.59	0.50
Poland	0.68	0.45	0.53	0.41
Romania	0.72	0.32	0.61	0.33
Slovakia	0.62	0.21	0.53	0.40
Slovenia	0.72	0.11	0.64	0.15
Total	0.69	0.33	0.56	0.37

Note: The table presents statistics on the share of firms who declare bank loans desirable, and the share of firms out of those that need a loan that have been formally rejected or did not apply because they found access to finance too difficult, by country. The data are for the fiscal year 2007 (until March 31, 2008) and for fiscal year 2004 (until March 31, 2005). See Appendix 1 for exact definitions and data sources.

Table 3.
Bank regulation and supervision

Panel A. Home countries

Country	Regulatory stringency	Prudential supervision	Regulatory restrictions	Capital stringency
Austria	1.5	2.5	5	5
Belgium	0	2.5	9	4
Denmark	0	3	8	2
Finland	2	1	7	4
France	0	3	6	2
Germany	2	3	5	1
Greece	2.5	2	9	3
Ireland	0	3	8	1
Italy	0.5	2	10	4
Netherlands	0	2.75	6	3
Sweden	0	2	9	3
United States	0	3	12	4
Total	0.7	2.4	7.8	3

Panel B. Host countries

Country	Regulatory stringency	Prudential supervision	Regulatory restrictions	Capital stringency
Albania	1.910	2.117	7.474	3.977
Bulgaria	1.784	2.171	8.350	3.328
Croatia	0.856	2.187	8.171	4.124
Czech Republic	0.610	2.623	6.781	3.804
Estonia	0.332	2.016	8.486	2.984
Hungary	1.033	2.288	7.345	4.062
Latvia	0.478	2.000	4.535	1.512
Lithuania	0.156	2.159	7.390	2.536
Macedonia	1.625	2.368	7.825	2.561
Poland	0.349	2.464	8.753	2.848
Romania	1.210	2.483	6.668	3.693
Slovakia	0.920	2.418	7.141	4.534
Slovenia	0.198	2.621	8.190	3.649
Total	0.851	2.340	7.541	3.324

Note: The table reports summary statistics on average strength of over 2002-2005 of bank supervision and regulation, by home (Panel A) and host (Panel B) country. 'Regulatory stringency' is an index of the strength of regulatory restrictions over 2002-2005, taken from Abiad et al. (2008). 'Prudential supervision' is an index of the scope and efficiency of home-country supervision over 2002-2005, taken from Abiad et al. (2008). 'Restrictions on bank activities' is an index of regulatory restrictions on the activities of banks over 2002-2005, taken from Barth et al. (2008). 'Capital stringency' is an index of regulatory oversight of bank capital over 2002-2005, taken from Barth et al. (2008). In Panel B, the three variables are locality-specific and are constructed by weighting by number of branches the respective home-country variable for each parent bank which has at least one branch or subsidiary in that locality. See Appendix 1 for exact definitions and data sources.

Table 4.
Probability of positive demand for credit

	Equally-weighted	Branch-weighted
Regulatory stringency	-0.153	-0.122
	(0.087)*	(0.086)
Prudential supervision	-0.191	-0.214
	(0.114)*	(0.115)*
Restrictions on bank activities	0.013	-0.016
	(0.040)	(0.034)
Capital stringency	-0.037	-0.022
	(0.082)	(0.067)
Small firm	-0.133	-0.152
	(0.050)***	(0.051)***
Big firm	0.055	0.048
	(0.101)	(0.101)
Public company	-0.014	-0.086
	(0.084)	(0.087)
Sole proprietorship	0.191	0.207
	(0.041)***	(0.042)***
Privatized	0.206	0.152
	(0.057)***	(0.058)***
Non-exporter	-0.154	-0.193
	(0.038)***	(0.039)***
Opaque	-0.124	-0.127
	(0.037)***	(0.038)***
Firm age	-0.001	-0.001
	(0.001)	(0.001)
Innovative	-0.185	-0.185
	(0.035)***	(0.036)***
Competition	0.131	0.127
	(0.041)***	(0.042)***
Subsidized	0.312	0.303
	(0.053)***	(0.055)***
Number of observations	6,357	6,020
Pseudo R-squared	0.05	0.05

Note: The dependent variable is a dummy variable equal to 1 if the firm desires bank credit. 'Regulatory stringency' is an index of regulatory restrictions. 'Prudential supervision' is an index of the scope and efficiency of home-country supervision. 'Restrictions on bank activities' is an index of regulatory restrictions on the activities of banks. 'Capital stringency' is an index of regulatory oversight of bank capital. The three variables are locality-specific and are constructed by weighting equally (Columns labelled "Equally-weighted") or by the number of branches (Columns labelled "Branch-weighted") the respective variable for each parent bank which has at least one branch or subsidiary in that locality. 'Small firm' is a dummy equal to 1 if the firm has from 2 to 49 employees. 'Big firm' is a dummy equal to 1 if the firm has more than 250 employees. 'Public company' is a dummy equal to 1 if the firm is a shareholder company, or its shares traded in the stock market. 'Sole proprietorship' is a dummy equal to 1 if the firms is a sole proprietorship. 'Privatized' is a dummy equal to 1 if the firm is a former state-owned company. 'Non-Exporter' is a dummy equal to 1 if the firm does not export to foreign markets. 'Opaque' is a dummy equal to 1 if the firm does not employ external auditing services. 'Firm age' is the firm's age in years. 'Innovative' is a dummy equal to 1 if the firm has introduced a new product line in the past 3 years. 'Competition' is a dummy equal to 1 if the firm faces fairly, very, or extremely strong competition.

‘Subsidized’ is a dummy equal to 1 if the firm has received in the last 3 years subsidies from central or local government. Omitted category in firm size is ‘Medium firm’. Omitted category in firm ownership is ‘Private company’. Only localities where branches and subsidiaries of foreign banks account for more than 50% of the local market are included. All regressions include country and year fixed effects. White (1980) robust standard errors are reported in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. See Appendix 1 for exact definitions and data sources.

Table 5.
Home country bank regulation and supervision, and host-country loan rejection rates

Panel A. Equally-weighted regulation and supervision data						
	(1)	(2)	(3)	(4)	(5)	(6)
Regulatory stringency	-0.079				-0.133	-0.240
	(0.121)				(0.131)	(0.133)*
Prudential supervision		0.344			0.276	0.198
		(0.152)**			(0.165)*	(0.175)
Restrictions on bank			-0.074		-0.066	-0.080
activities			(0.047)		(0.056)	(0.057)
Capital stringency				-0.106	0.023	0.037
				(0.099)	(0.116)	(0.118)
Small firm	0.454	0.460	0.458	0.455	0.460	0.356
	(0.069)***	(0.069)***	(0.069)***	(0.069)***	(0.069)***	(0.073)***
Big firm	-0.110	-0.121	-0.114	-0.112	-0.117	-0.045
	(0.149)	(0.149)	(0.149)	(0.149)	(0.149)	(0.153)
Public company	0.233	0.233	0.227	0.229	0.238	0.219
	(0.119)*	(0.120)*	(0.119)*	(0.120)*	(0.120)**	(0.120)*
Sole proprietorship	0.120	0.098	0.115	0.118	0.104	0.207
	(0.053)**	(0.054)*	(0.053)**	(0.053)**	(0.054)*	(0.061)***
Privatized	-0.175	-0.181	-0.173	-0.173	-0.181	-0.037
	(0.077)**	(0.077)**	(0.077)**	(0.077)**	(0.077)**	(0.082)
Non-exporter	0.234	0.234	0.233	0.234	0.234	0.127
	(0.049)***	(0.049)***	(0.049)***	(0.049)***	(0.049)***	(0.056)**
Opaque	0.370	0.369	0.369	0.368	0.371	0.297
	(0.049)***	(0.049)***	(0.049)***	(0.049)***	(0.049)***	(0.052)***
Firm age	0.002	0.002	0.002	0.002	0.002	0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Innovative	0.217	0.217	0.215	0.216	0.215	0.093
	(0.046)***	(0.046)***	(0.046)***	(0.046)***	(0.046)***	(0.055)*
Inverse Mills' ratio						-0.319
						(0.084)***
Number of observations	3,945	3,945	3,945	3,945	3,945	3,945
Pseudo R-squared	0.15	0.15	0.15	0.15	0.15	0.15

Panel B. Branch-weighted regulation and supervision data						
	(1)	(2)	(3)	(4)	(5)	(6)
Regulatory stringency	-0.171				-0.178	-0.243
	(0.097)*				(0.104)*	(0.116)**
Prudential supervision		0.041			0.106	0.038
		(0.142)			(0.161)	(0.162)
Restrictions on bank			0.038		0.014	0.001
activities			(0.039)		(0.046)	(0.046)
Capital stringency				0.052	0.094	0.100
				(0.078)	(0.093)	(0.094)
Small firm	0.501	0.505	0.504	0.503	0.501	0.402
	(0.070)***	(0.070)***	(0.070)***	(0.070)***	(0.070)***	(0.075)***
Big firm	-0.079	-0.085	-0.083	-0.085	-0.083	-0.039
	(0.150)	(0.150)	(0.150)	(0.150)	(0.150)	(0.153)
Public company	0.184	0.171	0.173	0.170	0.186	0.136
	(0.128)	(0.128)	(0.128)	(0.128)	(0.128)	(0.128)
Sole proprietorship	0.134	0.124	0.127	0.126	0.128	0.215
	(0.054)**	(0.054)**	(0.054)**	(0.054)**	(0.055)**	(0.063)***
Privatized	-0.103	-0.102	-0.102	-0.102	-0.108	-0.023
	(0.078)	(0.078)	(0.078)	(0.078)	(0.078)	(0.081)
Non-exporter	0.246	0.246	0.246	0.245	0.246	0.142
	(0.050)***	(0.050)***	(0.050)***	(0.050)***	(0.050)***	(0.060)**
Opaque	0.379	0.377	0.376	0.377	0.380	0.325
	(0.050)***	(0.050)***	(0.050)***	(0.050)***	(0.050)***	(0.054)***
Firm age	0.001	0.001	0.001	0.001	0.001	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Innovative	0.195	0.197	0.197	0.197	0.196	0.102
	(0.047)***	(0.047)***	(0.047)***	(0.047)***	(0.047)***	(0.057)*
Inverse Mills' ratio						-0.318
						(0.094)***
Number of observations	3,736	3,736	3,736	3,736	3,736	3,736
Pseudo R-squared	0.15	0.15	0.15	0.15	0.15	0.15

Note: The dependent variable is a dummy variable equal to 1 if the firm's credit application has been rejected. 'Regulatory stringency' is an index of regulatory restrictions. 'Prudential supervision' is an index of the scope and efficiency of home-country supervision. 'Restrictions on bank activities' is an index of regulatory restrictions on the activities of banks. 'Capital stringency' is an index of regulatory oversight of bank capital. The three variables are locality-specific and are constructed by weighting equally (Panel A) or by the number of branches (Panel B) the respective variable for each parent bank which has at least one branch or subsidiary in that locality. 'Small firm' is a dummy equal to 1 if the firm has from 2 to 49 employees. 'Big firm' is a dummy equal to 1 if the firm has more than 250 employees. 'Public company' is a dummy equal to 1 if the firm is a shareholder company, or its shares traded in the stock market. 'Sole proprietorship' is a dummy equal to 1 if the firms is a sole proprietorship. 'Privatized' is a dummy equal to 1 if the firm is a former state-owned company. 'Non-exporter' is a dummy equal to 1 if the firm does not export to foreign markets. 'Opaque' is a dummy equal to 1 if the firm does not employ external auditing services. 'Firm age' is the firm's age in years. 'Innovative' is a dummy equal to 1 if the firm has introduced a new product line in the past 3 years. 'Inverse Mills' ratio' is the inverse of Mills' ratio from the probit model in Table 4 for each respective financial variable. Omitted category in firm size is 'Medium firm'. Omitted category in firm ownership is 'Private company'. Omitted categories from the probit equation in Table 5 are 'Competition' and 'Subsidized'. Only localities where branches and subsidiaries of foreign banks account for more than 50% of the local market are included. All regressions include country and industry fixed effects. White (1980) robust standard errors are reported in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. See Appendix 1 for exact definitions and data sources.

Table 6.
Home country bank regulation and supervision, and host-country loan rejection rates: Interaction with firm risk

	Equally-weighted				Branch-weighted			
	Risk = Small firm	Risk = Opaque	Risk = Non-exporter	Risk = Innovates	Risk = Small firm	Risk = Opaque	Risk = Non-exporter	Risk = Innovates
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Regulatory stringency × Risk	0.241	0.212	0.099	0.134	0.198	0.194	0.186	0.195
	(0.124)*	(0.088)**	(0.091)	(0.075)*	(0.113)*	(0.083)**	(0.087)**	(0.080)**
Prudential supervision × Risk	0.002	-0.142	-0.131	0.181	0.074	-0.207	-0.286	0.135
	(0.234)	(0.192)	(0.199)	(0.189)	(0.209)	(0.169)	(0.166)*	(0.167)
Restrictions on bank activities × Risk	0.031	0.059	0.044	-0.025	-0.031	-0.084	0.045	-0.008
	(0.074)	(0.061)	(0.065)	(0.057)	(0.050)	(0.041)**	(0.042)	(0.039)
Capital stringency × Risk	-0.080	0.081	0.112	-0.243	-0.110	0.022	0.087	-0.180
	(0.090)	(0.071)	(0.074)	(0.072)***	(0.079)	(0.061)	(0.062)	(0.061)***
Regulatory stringency	-0.450	-0.327	-0.218	-0.486	-0.415	-0.341	-0.197	-0.578
	(0.172)***	(0.140)**	(0.136)	(0.198)**	(0.155)***	(0.126)***	(0.118)*	(0.179)***
Prudential supervision	0.174	0.254	0.225	-0.198	-0.045	0.115	0.121	-0.252
	(0.263)	(0.205)	(0.186)	(0.341)	(0.240)	(0.185)	(0.172)	(0.307)
Restrictions on bank activities	-0.107	-0.105	-0.098	-0.068	0.020	0.045	-0.017	-0.010
	(0.085)	(0.068)	(0.059)*	(0.104)	(0.063)	(0.051)	(0.048)	(0.076)
Capital stringency	0.104	-0.009	0.003	0.407	0.189	0.071	0.076	0.375
	(0.139)	(0.124)	(0.119)	(0.159)**	(0.115)	(0.099)	(0.096)	(0.134)***
Small firm	0.177	0.379	0.354	0.347	0.641	0.425	0.400	0.398
	(0.828)	(0.074)***	(0.073)***	(0.073)***	(0.595)	(0.076)***	(0.075)***	(0.075)***
Big firm	-0.027	-0.024	-0.041	-0.026	-0.036	-0.021	-0.035	-0.020
	(0.154)	(0.153)	(0.153)	(0.152)	(0.153)	(0.153)	(0.153)	(0.152)
Public company	0.216	0.216	0.221	0.213	0.121	0.120	0.142	0.121
	(0.120)*	(0.120)*	(0.120)*	(0.120)*	(0.127)	(0.128)	(0.128)	(0.127)

Sole proprietorship	0.205	0.212	0.208	0.214	0.217	0.221	0.216	0.225
	(0.061)***	(0.061)***	(0.061)***	(0.061)***	(0.063)***	(0.063)***	(0.063)***	(0.063)***
Privatized	-0.039	-0.043	-0.034	-0.029	-0.020	-0.029	-0.021	-0.017
	(0.082)	(0.082)	(0.082)	(0.082)	(0.081)	(0.081)	(0.081)	(0.081)
Non-exporter	-0.125	-0.128	-0.442	-0.131	-0.142	-0.146	0.065	-0.143
	(0.056)**	(0.056)**	(0.760)	(0.056)**	(0.060)**	(0.060)**	(0.515)	(0.061)**
Opaque	0.304	-0.299	0.300	0.295	0.329	1.167	0.327	0.32
	(0.053)***	-0.735	(0.052)***	(0.052)***	(0.054)***	(0.512)**	(0.054)***	(0.054)***
Firm age	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Innovative	0.098	0.097	0.096	0.543	0.106	0.108	0.103	0.259
	(0.055)*	(0.056)*	(0.055)*	(0.708)	(0.057)*	(0.057)*	(0.057)*	(0.496)
Inverse Mills' ratio	-0.312	-0.311	-0.321	-0.333	-0.251	-0.239	-0.254	-0.266
	(0.083)***	(0.084)***	(0.083)***	(0.084)***	(0.084)***	(0.086)***	(0.085)***	(0.085)***
Observations	3,945	3,945	3,945	3,945	3,736	3,736	3,736	3,736
Pseudo R-squared	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14

Note: The dependent variable is a dummy variable equal to 1 if the firm's credit application has been rejected. 'Regulatory stringency' is an index of regulatory restrictions. 'Prudential supervision' is an index of the scope and efficiency of home-country supervision. 'Restrictions on bank activities' is an index of regulatory restrictions on the activities of banks. 'Capital stringency' is an index of regulatory oversight of bank capital. The three variables are locality-specific and are constructed by weighting equally (Columns labelled "Equally-weighted") or by the number of branches (Columns labelled "Branch-weighted") the respective variable for each parent bank which has at least one branch or subsidiary in that locality. 'Small firm' is a dummy equal to 1 if the firm has from 2 to 49 employees. 'Big firm' is a dummy equal to 1 if the firm has more than 250 employees. 'Public company' is a dummy equal to 1 if the firm is a shareholder company, or its shares traded in the stock market. 'Sole proprietorship' is a dummy equal to 1 if the firms is a sole proprietorship. 'Privatized' is a dummy equal to 1 if the firm is a former state-owned company. 'Non-exporter' is a dummy equal to 1 if the firm does not export to foreign markets. 'Opaque' is a dummy equal to 1 if the firm does not employ external auditing services. 'Firm age' is the firm's age in years. 'Innovative' is a dummy equal to 1 if the firm has introduced a new product line in the past 3 years. 'Inverse Mills' ratio' is the inverse of Mills' ratio from the probit model in Table 4 for each respective financial variable. Omitted category in firm size is 'Medium firm'. Omitted category in firm ownership is 'Private company'. Omitted categories from the probit equation in Table 5 are 'Competition' and 'Subsidized'. Only localities where branches and subsidiaries of foreign banks account for more than 50% of the local market are included. All regressions include country and industry fixed effects. White (1980) robust standard errors are reported in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. See Appendix 1 for exact definitions and data sources.

Table 7.
Home country bank regulation and supervision, and host-country loan rejection rates: Interaction between regulation and supervision

	Equally-weighted				Branch-weighted			
	Risk = Small firm	Risk = Opaque	Risk = Non-exporter	Risk = Innovates	Risk = Small firm	Risk = Opaque	Risk = Non-exporter	Risk = Innovates
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Regulatory stringency ×	0.952	0.307	0.938	0.359	0.554	-0.130	0.540	0.137
×Prudential supervision × Risk	(0.521)*	(0.397)	(0.400)**	(0.390)	(0.526)	(0.387)	(0.412)	(0.393)
Restrictions on bank activities ×	0.059	0.353	0.439	0.036	-0.023	0.051	0.132	-0.102
×Prudential supervision × Risk	(0.257)	(0.216)*	(0.226)**	(0.211)	(0.228)	(0.179)	(0.189)	(0.181)
Capital stringency ×	-0.038	0.601	-0.174	0.047	-0.151	0.415	-0.027	-0.009
×Prudential supervision × Risk	(0.334)	(0.279)**	(0.282)	(0.268)	(0.298)	(0.222)*	(0.233)	(0.230)
Number of observations	3,945	3,945	3,945	3,945	3,736	3,736	3,736	3,736
Pseudo R-squared	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14

Note: The dependent variable is a dummy variable equal to 1 if the firm's credit application has been rejected. 'Regulatory stringency' is an index of regulatory restrictions. 'Prudential supervision' is an index of the scope and efficiency of home-country supervision. 'Restrictions on bank activities' is an index of regulatory restrictions on the activities of banks. 'Capital stringency' is an index of regulatory oversight of bank capital. The three variables are locality-specific and are constructed by weighting equally (Columns labelled "Equally-weighted") or by the number of branches (Columns labelled "Branch-weighted") the respective variable for each parent bank which has at least one branch or subsidiary in that locality. All other covariates from Table 6 are also included in the regressions, alongside all possible double interaction between the three regulatory variables, 'Prudential supervision', and the four measures of risk. Only localities where branches and subsidiaries of foreign banks account for more than 50% of the local market are included. All regressions include country and industry fixed effects. White (1980) robust standard errors are reported in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. See Appendix 1 for exact definitions and data sources.

Table 8.
Home country bank regulation and supervision, and host-country risk-taking: Accounting for balance sheet strength

	Equally-weighted				Branch-weighted			
	Risk = Small firm	Risk = Opaque	Risk = Non-exporter	Risk = Innovates	Risk = Small firm	Risk = Opaque	Risk = Non-exporter	Risk = Innovates
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Regulatory stringency × Risk	0.264	0.163	0.056	0.112	0.175	0.117	0.113	0.141
	(0.126)**	(0.090)*	(0.094)	(0.087)	(0.104)*	(0.089)	(0.095)	(0.078)*
Prudential supervision × Risk	0.003	-0.207	-0.07	0.164	0.019	-0.333	-0.182	0.073
	(0.235)	(0.195)	(0.202)	(0.191)	(0.217)	(0.176)*	(0.183)	(0.173)
Restrictions on bank activities × Risk	0.042	-0.044	0.143	-0.079	-0.061	-0.163	0.114	-0.058
	(0.102)	(0.074)	(0.079)*	(0.072)	(0.069)	(0.053)***	(0.054)**	(0.053)
Capital stringency × Risk	-0.086	0.137	0.063	-0.211	-0.085	0.096	0.031	-0.134
	(0.094)	(0.076)*	(0.078)	(0.076)***	(0.089)	(0.068)	(0.070)	(0.069)*
Tier 1 capital × Risk	-0.005	0.225	0.206	0.094	0.063	0.151	0.135	0.085
	(0.115)	(0.081)***	(0.091)**	(0.081)	(0.085)	(0.062)**	(0.067)**	(0.062)
Number of observations	3,945	3,945	3,945	3,945	3,736	3,736	3,736	3,736
Pseudo R-squared	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14

Note: The dependent variable is a dummy variable equal to 1 if the firm's credit application has been rejected. 'Regulatory stringency' is an index of regulatory restrictions. 'Prudential supervision' is an index of the scope and efficiency of home-country supervision. 'Restrictions on bank activities' is an index of regulatory restrictions on the activities of banks. 'Capital stringency' is an index of regulatory oversight of bank capital. 'Tier 1 capital' is an index of bank capitalization weighted for risk. The four regulatory/supervisory variables and Tier 1 are locality-specific and are constructed by weighting equally (Columns labelled "Equally-weighted") or by number of branches (Columns labelled "Branch-weighted") the respective variable for each parent bank which has at least one branch or subsidiary in that locality. All other covariates from Table 6 are also included in the regressions. Only localities where branches and subsidiaries of foreign banks account for more than 50% of the local market are included. All regressions include country and industry fixed effects. White (1980) robust standard errors are reported in parentheses, where *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. See Appendix 1 for exact definitions and data sources.

Appendix 1. Domestic and parent banks in the sample

Country	Bank	Parent bank and country of incorporation
Albania	Alpha Bank	Alpha Bank - Greece
	Raiffeisen	Raiffeisen - Austria
	Banka Kombetare Trektare	Domestic
	Tirana Bank	Pireus Bank - Greece
	Intessa San Paolo Bank Albania	Intessa San Paolo - Italy
	National Bank of Greece	National Bank of Greece
	Emporiki	Emporiki Bank - Greece
	Banka Credins	Domestic
Bulgaria	Alpha bank	Alpha Bank - Greece
	Unicredit Bulbank	UniCredit Group - Italy
	DSK	OTP - Hungary
	First Investment Bank	Domestic
	PostBank	EFG Eurobank - Greece
	Expressbank	Societe Generale - France
	United Bulgarian Bank	National Bank of Greece
	Raiffeisen	Raiffeisen - Austria
	Piraeus	Piraeus Bank - Greece
Croatia	Zagrebaska Bank	UniCredit Group - Italy
	Privredna Bank Zagreb	Intessa San Paolo - Italy
	Erste & Steiermarkische Bank	Erste Group - Austria
	Raiffeisen Bank	Raiffeisen - Austria
	Societe Generale - Splitska Banka	Societe Generale - France
	Hypo Alde Adria Bank	Hypo Group - Austria
	OTP Banka Hrvatska	OTP - Hungary
	Slavonska Banka	Domestic
	Hrvatska Postanska Banka	Domestic
Czech Republic	Ceska Sporitelna	Erste Group - Austria
	CSOB	KBC - Belgium
	Komercni Banka	Societe Generale - France
	UniCredit Bank CR	UniCredit Group - Italy
	Citibank	Citibank - US
	Ceskomoravska zarucni a rozvojova banka	Domestic
	GE Money Bank	GE Money - US
	Hypotecni Banka	KBC - Belgium
	Raiffeisenbank	Raiffeisen - Austiia
Estonia	Swedbank Estonia	Swedbank - Sweden
	SEB	Skandinavska Enskilda Banken - Sweden
	Sampo Pank	Danske Bank - Denmark
	Nordea	Nordea Bank - Finland
Hungary	OTP Bank	Domestic
	K&H Commercial and Credit Bank	KBC – Belgium
	MKB Bank	Bayerische Landesbank - Germany
	CIB Bank	Intessa San Paolo - Italy
	Raiffeisen Bank	Raiffeisen – Austria
	Erste Bank Hungary	Erste Group - Austria
	KDB Bank	KDB Seoul – Korea
	UniCredit Bank Hungary	UniCredit Group - Italy
Latvia	Parex	Domestic
	Hansabank	Swedbank – Sweden
	Latvijas Krajbanka	Snoras Bank - Lithuania
	SMP Bank	Domestic
	Rietumu Banka	Domestic

	Trasta Komercbanka	Domestic
Lithuania	SEB	Skandinavska Enskilda Banken - Sweden
	Sampo Pank	Danske Bank - Denmark
	Nordea	Nordea Bank - Finland
	Snoras Bank	Domestic
	Ukio Bankas	Domestic
	Hansabankas	Swedbank – Sweden
	Parex Bankas	Parex Group – Latvia
Macedonia	Alpha Bank	Alpha Bank – Greece
	Stopanska Banka	National Bank of Greece
	Komercijalna Banka	Domestic
	NLB Tutunska Banka	NLB - Slovenia
	Ohridska Banka	Societe Generale - France
	Pro Credit Bank	Pro Credit Group
Poland	PKO Bank	Domestic
	Bank Pekao	UniCredit Group - Italy
	Bank BPH	UniCredit Group - Italy
	Bank Zachodni WBK	AIB –– Ireland
	ING Bank Slaski	ING Bank - Netherlands
	Bank Pocztowy	Domestic
	Kredyt Bank	KBC - Belgium
	mBank	Commerzbank - Germany
	Getin Bank	Domestic
Romania	BCR	Erste Group - Austria
	BRD Group Societe General	Societe Generale - France
	Volksbank Romania	Volksbank - Austria
	Raiffeisen Bank	Raiffeisen - Austria
	Alpha Bank Romania	Alpha Bank – Greece
	UniCredit Tiriac Bank	UniCredit Group - Italy
	Banca Transilvania	Domestic
	Bancpost	EFG Eurobank - Greece
	CEC Bank	Domestic
Slovakia	Vseobecna Uverova banka	Intessa San Paolo - Italy
	Slovenska Sporitelna	Erste Group - Austria
	Tatra Banka	Raiffeisen – Austira
	OTP Banka Slovensko	OTP – Hungary
	Dexia Banka Slovensko	Dexia – Belgium
	UniCredit Bank Slovakia	UniCredit Group - Italy
	Volksbank Slovensko	Volksbank - Austria
	CSOB Slovakia	KBC – Belgium
Slovenia	Nova Ljubljanska Banka	KBC – Belgium
	Nova Kreditna Banka Maribor	Domestic
	Abanka	Domestic
	SKB	Societe Generale - France
	UniCredit	UniCredit Group - Italy
	Banka Koper	Intessa San Paolo - Italy
	Banka Celje	Domestic
	Reiffeisen Krekova banka	Raiffeisen - Austria

Appendix 2. Bank data coverage

Country	Ratio assets of the banks in the data set to total assets of the country's banking sector
Albania	0.982
Bulgaria	0.857
Croatia	0.887
Czech Republic	0.913
Estonia	0.956
Hungary	0.948
Latvia	0.851
Lithuania	0.896
Macedonia	0.877
Poland	0.859
Romania	0.904
Slovakia	0.925
Slovenia	0.862

Source: Bankscope (2008).

Appendix 3. Variables – definitions and sources

Variable Name	Definition	Source
	Firm characteristics	
Small firm	Dummy=1 if firm has less than 99 employees.	BEEPS 2005 & 2008
Medium firm	Dummy=1 if the firm has between 100 and 499 employees.	BEEPS 2005 & 2008
Big firm	Dummy=1 if firm has more than 500 employees.	BEEPS 2005 & 2008
Public company	Dummy=1 if firm is a shareholder company / shares traded in the stock market.	BEEPS 2005 & 2008
Private company	Dummy=1 if firm is a shareholder company / shares traded privately if at all.	BEEPS 2005 & 2008
Sole proprietorship	Dummy=1 if firm is a sole proprietorship.	BEEPS 2005 & 2008
Privatized	Dummy=1 if the firm went from state to private ownership in the past.	BEEPS 2005 & 2008
Subsidized	Dummy=1 if the firm has received state subsidized in the past year.	BEEPS 2005 & 2008
Non-exporter	Dummy=1 if no part of the firm's production is exported to foreign markets.	BEEPS 2005 & 2008
Competition	Dummy=1 if pressure from competitors is "fairly" or "very" severe.	BEEPS 2005 & 2008
Opaque	Dummy=1 if the firm does not subject its financial accounts to external audit.	BEEPS 2005 & 2008
Firm age	The number of years since the firm was officially incoroprated.	BEEPS 2005 & 2008
Innovative	Dummy=1 if the firm has introduced at least one new credit line in the past 3 years.	BEEPS 2005 & 2008
	Credit demand and credit access	
Need loan	Dummy=1 if the firm doesn't need a loan because it has sufficient capital.	BEEPS 2005 & 2008
Constrained	Dummy=1 if the firm's application for a bank loan was rejected.	BEEPS 2005 & 2008
	Bank-level variables	
Regulatory stringency	Composite index of 6 types of regulatory restrictions: credit controls and ceilings, interest rate controls, entry barriers, privatization, restrictions on international capital flows, and security markets regulation.	Abiad et al. (2008)
Prudential supervision	Composite index of 4 types of government intervention in prudential supervision: Basle-type capital adequacy ratio, independence from the executive, on-site and off-site supervision, coverage of all institutions.	Abiad et al. (2008)

Restrictions on bank activities	Composite index of regulatory restrictions on security market activities, insurance activities, real estate activities, and nonfinancial firm owenrship by banks.	Barth et al. (2008)
Capital stringency	Composite index of regulatory oversight of bank capital, including minimum capital requirement adjusted for risk, deduction of loan losses, securities losses, and foreign exchange losses not realized, fraction of revaluation gains allowed, verification of sources of funds to be used as capital, regulation of initial disbursement or subsequent injections of capital.	Barth et al. (2008)
Tier 1 capital	Ratio of Tier 1 capital to total risk-weighted assets	Bankscope 2005 & 2008